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REMARKS

In the Office Action mailed 02/21/2006, the Examiner made various statements in the Background section of the Office Action, with which applicant respectfully disagrees. Just by way of example, the Examiner argued in the Background section that the “[g]raphics hardware was used to compute solutions to a partial differential equation for visualization of flows (Harris, 2002, referring to cited earlier references).” Applicant respectfully asserts that the Harris reference discloses that “related to this is the visualization of flows described by PDEs, which has been implemented using graphics hardware to accelerate line integral convolution and Lagrangian-Eulerian advection” (emphasis added). However, accelerating “line integral convolution and Lagrangian-Eulerian advection” does not support the Examiner’s argument that “[g]raphics hardware was used to compute solutions to a partial differential equation for visualization of flows” (emphasis added).

The Examiner has rejected Claims 1-2, 12-18, 22-23, and 27 under 35 U.S.C. 103(a) as being unpatentable over Press (Press, William H.; Flannery, Brian P.; Teukolsky, Saul A.; Vetterling, William T.; “Numerical Recipes in Fortran 77”, 2001, Second Edition, Cambridge University Press) in view of Trendall (Trendall, Chris; Steward, A. James; “General Calculations using graphics hardware, with application to interactive caustics”, June 2000, “Rendering Techniques 2000: 11th Eurographics Workshop on Rendering”). Applicant respectfully disagrees with such rejection, especially in view of the amendments made hereinabove to the independent claims.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the

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prior art and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

With respect to the first element of the *prima facie* case of obviousness, the Examiner states that "the motivation to use the art of Trendall with the art of Press would have been the benefit recited in Trendall that calculations on functions or vector fields can be performed very quickly in graphics hardware." Applicant respectfully disagrees with this proposition, especially in view of the vast evidence to the contrary.

For example, Press relates to implementing mathematics in software, while Trendall relates to graphics hardware that implements different mathematics. To simply glean features from graphics hardware that implements different mathematics, such as that of Trendall, and combine the same with the *non-analogous art of software-implemented mathematics*, such as that of Press, would simply be improper. Graphics hardware implements mathematics in a hardware environment for improving hardware graphics processing, while software-implemented mathematics merely relates to using software to carry out mathematic operations. "In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned." *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992). See also *In re Deminski*, 796 F.2d 436, 230 USPQ 313 (Fed. Cir. 1986); *In re Clay*, 966 F.2d 656, 659, 23 USPQ2d 1058, 1060-61 (Fed. Cir. 1992). In view of the vastly different types of problems software-implemented mathematics addresses as opposed to graphics hardware-implemented mathematics, the Examiner's proposed combination is clearly inappropriate.

Further, by virtue of the sole focus of Press on software-implemented general mathematics, it is further argued that Press *teaches away* from the graphics hardware-oriented mathematics of Trendall and the claimed invention. *In re Hedges*, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986).

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Applicant respectfully asserts that it would have been *unobvious* to incorporate the partial differential equations from Press in the graphics hardware environment of Trendall, since only applicant has recognized the benefits of the same. Specifically, solutions to partial differential equations, in the graphics hardware environment context claimed by applicant, provide numerous *optional* advantages such as providing for more effective determination of a location of objects or surfaces to be rendered (as well as other possible advantages, etc.). Note the originally filed specification. Only applicant teaches and claims such a combination of features and components for the generation or computation of partial differential equation solutions for such purpose.

More importantly, with respect to the third element of the *prima facie* case of obviousness, the Examiner has relied on the Trendall reference to make a prior art showing of applicant's claimed technique "processing the input to generate the solution to the partial differential equation utilizing the hardware graphics pipeline" (see this or similar, but not necessarily identical language in the independent claims).

Applicant respectfully asserts that the Trendall reference merely teaches "[g]eneral calculations using graphics hardware" (Page 1, Title) to "accelerate the rendering process much earlier than at the latter image generation stages" (Page 1, Abstract). In particular, Trendall suggests that "an RGB or RGBA image can represent a three or four dimensional vector field defined over a subset of the plane" which is beneficial since "operations on an image are highly parallelized and calculations on entire functions or vector fields can be performed very quickly in graphics hardware" (Page 3, Section 3). However, these general calculations of the cited excerpts simply fail to disclose "processing the input to generate the solution to the partial differential equation utilizing the hardware graphics pipeline" (emphasis added), as claimed by applicant.

Furthermore, Trendall suggests using "a continuous approximation to the spreading of light after refraction, which leads to an integral that can be discretized" (Page 3, Section 2.2 – emphasis added) and that "the heightfield normals are calculated by convolving to get the x and y discrete partial derivatives, and then using pixel texturing to

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look up the associated normal” (Page 8, Section 4.2). Trendall’s suggestion of calculating heightfield normals by convolving clearly fails to meet “processing the input to generate the solution to the partial differential equation utilizing the hardware graphics pipeline” (emphasis added), as claimed by applicant.

Applicant respectfully asserts that at least the first and third element of the *prima facie* case of obviousness has not been met, as noted above. Nevertheless, despite such paramount deficiencies and in the spirit of expediting the prosecution of the present application, applicant has amended the independent claims to further distinguish applicant’s claim language from the above references, as follows:

“wherein the solution to the partial differential equation is generated utilizing the hardware graphics pipeline for enhancing graphics processing operations performed by the hardware graphics pipeline” (see this or similar, but not necessarily identical language in the independent claims).

It is thus now emphasized that the generation of the solution to the partial differential equation utilizing the hardware graphics pipeline is for the specific purpose of enhancing graphics processing operations performed by the hardware graphics pipeline. A notice of allowance or specific prior art showing of each of the foregoing claim elements, in combination with the remaining claimed features, is respectfully requested.

Applicant further notes that the prior art is also deficient with respect to the dependent claims. For example, with respect to Claim 10 et al., the Examiner has rejected the same under 35 U.S.C. 103(a) as being unpatentable over Press and Trendall and Weiskopf in view of Ewins (Ewins, Jon P.; Waller, Marcus D.; White, Martin; Lister, Paul F.; “MIP-Map Level; Selection for Texture Mapping”, 1998, IEEE Transaction on Visualization and Computer Graphics, Vol. 4, No. 4). Specifically, the Examiner has relied on pages 318-319, section 1.1 Texture Filtering, from the Ewins reference to make a prior art showing of applicant’s claimed technique “wherein the local area of textures is filtered utilizing a filter including a plurality of elements.”

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Applicant respectfully asserts that the excerpts from Ewins relied upon by the Examiner merely teach techniques for creating MIP-maps and performing bilinear and trilinear filtering. Ewins teaches that MIP-maps consist of “the prefiltering and storage of multiple texture maps of decreasing resolution which attempt to contain the same information in an increasingly smaller space” which is accomplished by “progressively averaging groups of four neighboring textels to format each new layer of the image pyramid” (emphasis added). However, “averaging groups of four neighboring textels” simply fails to meet a technique “wherein the local area of textures is filtered utilizing a filter including a plurality of elements” (emphasis added), as claimed by applicant.

Further, with respect to Claim 11, the Examiner has relied on pages 318-319, section 1.1 Texture Filtering, from the Ewins reference to make a prior art showing of applicant’s claimed technique “wherein the local area of textures is used to sample a texture map to generate a modified local area of textures.”

Again, applicant respectfully asserts that the excerpts from Ewins relied upon by the Examiner merely teach techniques for creating MIP-maps and performing bilinear and trilinear filtering. Ewins further discloses that MIP-maps are formed by “averaging groups of four neighboring textels” and “[t]rilinear interpolation is then achieved by linearly interpolating between the color values resulting from these two bilinear interpolations to the intermediate interpolation fraction f as shown” (emphasis added). However, the MIP-maps, bilinear, and trilinear filtering simply fail to even suggest a technique “wherein the local area of textures is used to sample a texture map to generate a modified local area of textures” (emphasis added), as claimed by applicant.

Again, applicant respectfully asserts that at least the first and third element of the *prima facie* case of obviousness has not been met, as noted above. Thus, a notice of allowance or specific prior art showing of each of the foregoing claim elements, in combination with the remaining claimed features, is respectfully requested.

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Still yet, applicant brings to the Examiner's attention the subject matter of new Claims 32-33 below, which are added for full consideration:

"wherein the graphics processing operations performed by the hardware graphics pipeline are enhanced by determining a location of surfaces rendered utilizing the solution to the partial differential equation generated utilizing the hardware graphics pipeline" (see Claim 32); and

"wherein the graphics processing operations performed by the hardware graphics pipeline are enhanced by determining a location of objects rendered utilizing the solution to the partial differential equation generated utilizing the hardware graphics pipeline" (see Claim 33).

Again, a notice of allowance or specific prior art showing of each of the foregoing claim elements, in combination with the remaining claimed features, is respectfully requested.

Thus, all of the independent claims are deemed allowable. Moreover, the remaining dependent claims are further deemed allowable, in view of their dependence on such independent claims.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 505-5100. The Commissioner is authorized to charge any additional fees or credit any overpayment to Deposit Account No. 50-1351 (Order No. NVIDP074).

Respectfully submitted,
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